

WHAT IS CLAIMED IS:

1. A thin film magnetic memory device, comprising:
  - a memory array having a plurality of magnetic memory cells arranged in rows and columns, each of said plurality of magnetic memory cells including
    - 5 a magnetic storage portion having a resistance value that varies according to a level of storage data to be written by first and second data write currents, and
    - a memory cell selection gate for passing a data read current therethrough into said magnetic storage portion in a data read operation;
    - 10 a plurality of read word lines provided corresponding to the respective rows of the magnetic memory cells, for actuating the corresponding memory cell selection gate according to a row selection result in said data read operation;
    - a plurality of data lines provided corresponding to the respective
    - 15 columns of the magnetic memory cells, for causing said first data write current and said data read current to flow therethrough in a data write operation and said data read operation, respectively;
    - a plurality of write word lines provided corresponding to the respective rows, and selectively activated according to a row selection result
    - 20 in said data write operation so as to cause said second data write current to flow therethrough; and
    - a plurality of reference voltage lines provided corresponding to either the respective rows or the respective columns, for supplying a reference voltage to be used in said data read operation, wherein
    - 25 adjacent magnetic memory cells share a corresponding one of at least one of said plurality of write word lines, said plurality of read word lines, said plurality of data lines and said plurality of reference voltage lines.
2. The thin film magnetic memory device according to claim 1, wherein
  - every two of said plurality of data lines form a data line pair in said

data read operation and said data write operation,

5       the magnetic memory cells selected by a same read word line are respectively connected to one of the two data lines of each of said data line pairs, and a plurality of magnetic memory cells selected by a same write word line are respectively connected to the other data line of each of said data line pairs,

10       said data read current is supplied to each of the two data lines of the data line pair corresponding to a column selection result, and

      said first data write current is supplied to each of said two data lines as currents of opposite directions.

3. A thin film magnetic memory device, comprising:

      a memory array having a plurality of magnetic memory cells arranged in rows and columns, each of said plurality of magnetic memory cells including

5       a magnetic storage portion having a resistance value that varies according to a level of storage data to be written by first and second data write currents, and

      a memory cell selection gate for passing a data read current therethrough into said magnetic storage portion in a data read operation;

10       a plurality of read word lines provided corresponding to the respective rows of the magnetic memory cells, for actuating the corresponding memory cell selection gate according to a row selection result in said data read operation;

15       a plurality of data lines provided corresponding to the respective columns of the magnetic memory cells, for causing said first data write current and said data read current to flow therethrough in a data write operation and said data read operation, respectively;

20       a plurality of write word lines provided corresponding to the respective rows, and selectively activated according to a row selection result in said data write operation so as to cause said second data write current to flow therethrough; and

      a word line current control circuit for coupling said plurality of write

word lines to a reference voltage that is used in said data read operation, wherein

25        adjacent magnetic memory cells share a corresponding one of at least one of said plurality of write word lines, said plurality of read word lines and said plurality of data lines.

4. The thin film magnetic memory device according to claim 3, wherein

5        said adjacent magnetic memory cells share one of the corresponding write word line and the corresponding data line, which is located farther from the respective magnetic storage portions, and  
      said one of the write word line and the data line has a larger cross-sectional area than that of the other of the write word line and the data line.

5. The thin film magnetic memory device according to claim 3, wherein one of each write word line and each data line, which is located farther from the corresponding magnetic storage portions, is formed from a material having higher electromigration resistance than that of the other of  
5        each write word line and each data line.

6. The thin film magnetic memory device according to claim 3, wherein

      adjacent magnetic memory cells in the column direction share a corresponding one of said plurality of write word lines,  
5        every two of said plurality of data lines form a data line pair in said data read operation,

      the magnetic memory cells selected by a same read word line are respectively connected to one of the two data lines of each of said data line pairs, and

10        said data read current is supplied to each of the two data lines of the data line pair corresponding to a column selection result.

7. The thin film magnetic memory device according to claim 3,

wherein

adjacent magnetic memory cells in the column direction share a corresponding one of said plurality of read word lines,

5 every two of said plurality of data lines form a data line pair in said data write operation,

a plurality of magnetic memory cells selected by a same write word line are respectively connected to one of the two data lines of each of said data line pairs, and

10 said first data write current is supplied to each of the two data lines of the data line pair corresponding to a column selection result as currents of opposite directions.

8. The thin film magnetic memory device according to claim 7, further comprising:

a switching circuit for electrically coupling the two data lines of said data line pair to each other in said data write operation, and

5 a data write circuit for supplying first and second voltages respectively to the two data lines of said data line pair corresponding to the column selection result in said data write operation.

9. A thin film magnetic memory device, comprising:

a memory array having a plurality of magnetic memory cells arranged in rows and columns, each of said plurality of magnetic memory cells including

5 a magnetic storage portion having a resistance value that varies according to a level of storage data to be written by first and second data write currents, and

a memory cell selection gate for passing a data read current therethrough into said magnetic storage portion in a data read operation;

10 a plurality of read word lines provided corresponding to the respective rows of the magnetic memory cells, for actuating the corresponding memory cell selection gate according to a row selection result in said data read operation;

15 a plurality of signal lines provided corresponding to the respective columns of the magnetic memory cells, a corresponding one of said plurality of signal lines being shared by adjacent magnetic memory cells in the row direction;

20 a read/write control circuit for supplying said first data write current and said data read current to said signal lines in a data write operation and said data read operation, respectively;

a plurality of write word lines provided corresponding to the respective rows, and selectively activated according to a row selection result in said data write operation so as to cause said second data write current to flow therethrough; and

25 a plurality of control switches provided respectively corresponding to said plurality of signal lines, for electrically coupling a reference voltage that is used in said data read operation to a corresponding one of said plurality of signal lines, wherein

30 said plurality of control switches each couples a selected one of two signal lines corresponding to the respective magnetic memory cells to said reference voltage, according to said column selection result.

10. The thin film magnetic memory device according to claim 9, wherein adjacent magnetic memory cells in the column direction share a corresponding one of at least one of said plurality of read word lines and said plurality of write word lines.

11. The thin film magnetic memory device according to claim 9, wherein

5 said adjacent magnetic memory cells share one of the corresponding write word line and the corresponding signal line, which is located farther from the respective magnetic storage portions, and

said one of the write word line and the signal line has a larger cross-sectional area than that of the other of the write word line and the data line.

12. The thin film magnetic memory device according to claim 9,

wherein one of each write word line and each signal line, which is located farther from the corresponding magnetic storage portions, is formed from a material having higher electromigration resistance than that of the other of each write word line and each signal line.

13. A thin film magnetic memory device, comprising:  
a memory array having a plurality of magnetic memory cells arranged in rows and columns, each of said plurality of magnetic memory cells including

a magnetic storage portion having a resistance value that varies according to a level of storage data to be written when a data write magnetic field applied by first and second data write currents is larger than a predetermined magnetic field, and

a memory cell selection gate for passing a data read current therethrough into said magnetic storage portion in a data read operation;

a plurality of write word lines provided corresponding to the respective rows of the magnetic memory cells, and selectively activated according to a row selection result in a data write operation so as to cause said first data write current to flow therethrough;

a plurality of read word lines provided corresponding to the respective rows, for actuating the corresponding memory cell selection gate according to a row selection result in said data read operation;

a plurality of write data lines provided corresponding to the respective columns of the magnetic memory cells, for causing said second data write current to flow therethrough in said data write operation; and

a plurality of read data lines provided corresponding to the respective columns, for causing said data read current to flow therethrough in said data read operation, wherein

adjacent magnetic memory cells share a corresponding one of at least one of said plurality of write word lines, said plurality of read word lines, said plurality of read data lines and said plurality of write data lines.

14. The thin film magnetic memory device according to claim 13,

wherein

said adjacent magnetic memory cells share one of the corresponding write word line and the corresponding write data line, which is located  
5 farther from the respective magnetic storage portions, and

said one of the write word line and the write data line has a larger cross-sectional area than that of the other of the write word line and the write data line.

15. The thin film magnetic memory device according to claim 13, wherein one of each write word line and each write data line, which is located farther from the corresponding magnetic storage portions, is formed from a material having higher electromigration resistance than that of the  
5 other of each write word line and each write data line.

16. The thin film magnetic memory device according to claim 13, wherein

adjacent magnetic memory cells in the column direction share a corresponding one of said plurality of write word lines,  
5 every two of said plurality of read data lines form a read data line pair in said data read operation,

the magnetic memory cells selected by a same read word line are respectively connected to one of the two read data lines of each of said read data line pairs, and

10 said data read current is supplied to each of the two read data lines of the read data line pair corresponding to a column selection result.

17. The thin film magnetic memory device according to claim 13, wherein

adjacent magnetic memory cells in the column direction share a corresponding one of said plurality of read word lines,  
5 every two of said plurality of write data lines form a write data line pair in said data write operation,

the magnetic memory cells selected by a same write word line are

respectively connected to one of the two write data lines of each of said write data line pairs, and

10        said second data write current is supplied to each of the two write data lines of the write data line pair corresponding to a column selection result as currents of opposite directions.

18. The thin film magnetic memory device according to claim 17, further comprising:

a switching circuit for electrically coupling the two write data lines of said write data line pair to each other in said data write operation, and

5        a data write circuit for supplying first and second voltages respectively to the two write data lines of said write data line pair corresponding to the column selection result in said data write operation.